

formula for the *Attidae* seems to be 4, 1, 3, 2; the fourth pair of legs being the longest and the second pair the shortest. In *Synageles picata* the formula, to judge from a figure (*l. c.*), is 4, 2, 3, 1. *Synemosyna fornicata*, another American spider observed by Peckham, has the usual formula, but is said to use its second pair of legs as antennæ!

I have mentioned that the spiders are probably protected from birds and other enemies by their resemblance to ants, but there can be no doubt that frequently they also thereby gain another very considerable advantage. The ants with which these spiders "most do congregate" are fairly omnivorous feeders, but shew a decided preference for sweet juices often to be found exuding from trees, fruit or flowers. To these juices come also flies, small beetles and other insects which form the natural prey of the spider, and which do not, under the circumstances, particularly fear the ants. Thus while the flies are sucking up sweetness in company with the ants, the spider is no doubt able, under cover of his disguise, to approach near enough to make a spring upon his unsuspecting victim and fix his sharp falcēs into its body. As regards the ants themselves, they do not seem to take any particular notice of the spiders, and do not apparently attack them. One spider, a mimic of *Ocophylla smaragdina* was found by me in a nest of these ants with its little silky shelter attached to one of the leaves which formed part of the abode of probably the most fierce of all the ants found in Bengal. It may also be supposed that the spider does not attack or annoy the ants.

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II.—*A List of the Butterflies of Engano, with some Remarks on the Danaidæ.*—By WILLIAM DOHERTY, *Cincinnati, U. S. A.* Communicated by the NATURAL HISTORY SECRETARY.

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(With Plate I, figs. 1—4.)

The long parallel lines of upheaval which characterize Burma are continued far into the Malayan region in the form of three great chains of islands and mountains. The most eastern of these, and the oldest, being chiefly composed of primitive rocks, consists of the Malay Peninsula, itself built up of several parallel ranges, the Riouw and Lingga groups, Banka and Billiton. The most western includes the Audamans and Nicobars, and the line of islands which may be called the Nias group, lying west of Sumatra, extending perhaps to western Java. Between these two the large island of Sumatra has been formed, probably in times geologically recent. No doubt some parts of Sumatra are composed of older rocks, but till the great volcanic up-

heaval occurred, its place was probably occupied by a few isolated islets, and to this day its fauna is chiefly made up of immigrants from the Malay Peninsula, and in the extreme south-west from Java, the number of endemic species being small. To understand the faunal relations of the Nias Islands, one must eliminate all idea of Sumatra from the mind. Until quite recent times, their relations were, I think, wholly with Java on the one side and the Nicobars on the other.

The Nias Islands lie like a broken breakwater along the western coast of Sumatra, in a line between five and six hundred miles in length, from Pulo Babi to South Pageh. They are separated from Sumatra by a deep channel nearly a hundred miles in breadth, but in two places more or less bridged by islands. Their united area is now only about 6000 square miles, equal to that of Yorkshire. But they seem to be the remains of a much larger mass of land. The deep sea that surrounds them swallows up all the alluvium from their streams; the tremendous surf on their western shore steadily undermines their hills, and under this process the islands have long been wearing away.

Engano lies much further south, and is wholly surrounded by deep sea, in which it might long ago have disappeared but for the coral reefs that protect most of its coast. It is only eighty miles from Sumatra, to which it has no faunal resemblance whatever. On the other hand, it is 180 miles from South Pageh in the Nias group, and 210 from Java. But on the side of Java there is only open sea, while on that of Nias there are three or four reefs and islets, and as might be expected from this, Engano may be zoologically considered as an outlying member of the Nias group, with certain Javan affinities.

An excellent description of the people and products of Engano has lately appeared in the *Tijdschrift van Nederlandsch Indië*, but so little is said of the island itself, that I may be permitted a few remarks on the subject. The area seems to be incorrectly stated; it is about a hundred and twenty square miles. The eastern coast is low and flat, bordered in places by mangrove swamps. The western, where the hills attain a height of nearly a thousand feet, descends precipitously into a narrow lagoon filled with branching corals and coral-haunting fishes, and on the reef beyond, the surf of one of the bluest and deepest of seas beats continually with such violence that the whole island seems to shake under it. Engano seems now to be sinking; it has formerly been more or less submerged. A shell of coral rock covers almost the whole of it, thick over the eastern lowlands, thinning gradually to the westward, so that the streams generally break through it there, and flow through deep gorges. In some places the crust has given way so as to form deep little round dells, with stalactite eaves piercing their sides,

and a subterranean stream roaring at the bottom, hidden by dense vegetation. The people believe these places to be haunted by evil spirits, and when I wanted to be lowered into one to look for shells in the caves, they all objected most vehemently.

Beneath the coral, the rock seems everywhere a coarse, friable sandstone. If the Nias islands consist generally of this soft rock, it will go far to explain their present fragmentary state.

Until the present generation, the population consisted of a number of hostile tribes, and the older men are still proficient in the use of the spear, and delight in mimic battles and dramatic representations of the surprise of a sleeping enemy. In recent times native vessels have taken to coming to Pulo Dua, two small islands a mile or two off the western coast, for cargoes of cocoa-nuts, and it is probably the growth of this trade that broke down the tribal system. At present Javanese and Malays have now settled in several villages, though Pulo Dua still remains their headquarters, the plague of sandflies making life unendurable to them on the main island. It is to the trading vessels that the Enganese also owe the introduction of diseases that are rapidly killing them off. An outbreak of small-pox carried off all the inhabitants of the two villages near the southern end of the island, and to this day this district is called the Land of Ghosts, and no Enganese will set foot on it. No alcoholic liquors have been brought to Engano; whether this is owing to the precautions of the Dutch, or the religious scruples of the Sumatran traders, I do not know. But syphilis was introduced many years ago, and through it the race has lost all reproductive power. In some of the villages there are hardly any children, and the area of cultivated land decreases every year. The Dutch government, I believe, now contemplates leasing the island to capitalists, and in another century it seems likely that the natives will be entirely replaced by Javanese coolies working under European supervision.

The islanders are of about the same degree of civilization as the Nicobarese. Till lately they are said to have gone about almost naked, and their island is always called Pulo Telanjang or the Naked Island by the Malays. They grow no rice, nor do they make use of the pandanus and cycas as food like the Nicobarese. They make little temporary clearings, surrounded by a stout fence to keep out wild pigs. Their staple food is the taro or *kaladi*,\* which they call *ayudapa*. They also have plantains, papayas and pumpkins, and eat quantities of cocoa-nuts, and drink the water in the nuts, the springs near the coast being usually brackish. They also draw toddy from the tree, though its use is not

\* Our word *Calladium*, though it looks Greek enough, is derived from this, the Malay name of the plant.

habitual as in the Nicobars. They keep fowls and a few pigs, feeding both on cocoa-nuts, and are expert in spearing fish and turtle. Thanks to this abundant diet and the rarity of famines, they have lost the woodman's instincts, and are little better acquainted with the forest and its vegetable and animal products, than are the rice-growing Malays of Borneo and Sumatra, who scarcely know the names of the commonest trees.

Their origin will perhaps puzzle future investigators. Though their physiognomy is odd and characteristic, they seem to be more or less allied to the Nicobarese, but without the negrito strain which seemed to me obvious in some members of that race. The theory has been advanced that the Nicobarese are of Shan or Siamese blood, no doubt on philological grounds, as there is no personal resemblance. On the other hand, the Malays are physically almost indistinguishable from the Siamese, and may roughly be defined as a Shan people, just touched with Polynesian blood in a few localities, and speaking a Polynesian language slightly mongolized.

A list of Enganese words is given in the article I have mentioned. The enunciation is curiously different from the Malay, and is difficult to follow, the vowels appearing to be uttered in several different tones, as in Shan or Chinese. As in Nicobarese, euphony is spoilt by the excessive number of imperfect k's and ng's (the French *n nasal*). These consonants, which rarely occur in Polynesian languages, except the Malay, are generally absent in the personal and place-names, which usually have a strikingly Polynesian air. I spent much of my time at Kayapu, where Pahakela (the *p* is always pronounced halfway between a *p* and an *f*) was chief: the names would be natural in New Zealand or Hawaii.

There seem to be no indigenous mammals on the island except bats, wild pigs and a *Paradoaxurus*. This absence of four-footed enemies may have been one cause of the excessive multiplication of birds. One sees more birds in a day in Engano, than in a month in Borneo or Sumatra, and coming from the latter island I was struck with their exceeding tameness. I saw four sorts of parrots and three of pigeons; the latter are never out of sight, the former keep up a deafening noise all day. The species seem generally different from the Sumatran, and no doubt some are undescribed. I think an ornithologist could do good work in Engano.

I think I got nine or ten sorts of land shells of which the greater number must be new. My small collections of moths and beetles were sent to England. The striking features of the latter were the prevalence of *Elateride* and the extreme rarity of *Phyllophaga*. No *Cassida* was taken at all.

Frogs, toads, snakes and lizards all abounded, and it is evident that the island has been at one time connected with the mainland, especially as a true cyprinoid fish appears to occur in the streams of the highlands. The coral crust does not imply the entire submergence of the island, while the number of peculiar butterflies shows its long isolation.

The forest is finest on the western coast, where the coral crust is thin or broken. The vegetation is there nearly as grand as on the mountain slopes of Sumatra. This side of the island is evidently very rainy. Even the comparatively barren eastern coast seems well suited to some plants, and in some places the pandani, which do not form thickets by themselves, as in the Nicobars, but grow among other trees, reach a surprising height, one I saw being fully a hundred feet high.

I caught fifty-eight kinds of butterflies, and saw two or three more on the day I landed. Three days of heavy rain followed, after which insects were scarce, and I obtained good sets of only a few species. The heavy forests of the interior scarcely produced anything but *Cyrestis perianther*, *Mycalesis mineus*, *Amathusia amythaon*, *Eoörylides tharis*, and *Paragerydus unicolor*. Most of the peculiar *Danaïdæ* occurred only close to the shore. Examination of the inland forest at another season may produce true endemic species, such as have been found in Nias. Should any future collector visit the island, I recommend Bua-bua, near the western coast, as the best collecting ground, and April or May as the best season. My own visit was in September, 1890, and lasted three weeks.

The species are mostly local forms of widely spread species. I have felt obliged to give names to thirteen of them, including nearly all of the *Danaïdæ*, and these should in most cases rather be called subspecies than species, but as I always give the name of the parent form, this ought to cause no difficulty. My types will be placed in the collection of the Hon. L. W. Rothschild. I have endeavoured to make in the text such comparisons as I could with the species taken by Herr Kheil in Nias, but I find it difficult to sum up the results.

While I have a few criticisms to make on Mr. Moore's well-known monograph of the *Danaïdæ*,\* I do not wish to appear ungrateful for the help he has there given to all students of this group. Though some have objected, he seems to have done right in giving names to the numerous subdivisions he has made. At the same time, most of them seem scarcely worthy of a higher rank than that of subgenera, and some are founded on minute and unreliable characters.† His classification

\* In the Proceedings of the Zoological Society for 1883.

† Such as the rudimentary recurrent vein in the cell of the forewing, a feature

is dubious, and some of his species worse than dubious. But in any case he has let a flood of light into one of the darkest corners of entomology, and all future work in this family must start from his as a base.

I do not see any reason for accepting his term *Euploina*, instead of the commonly received *Danaidæ* or *Danainæ*. The name *Danaus* necessarily falls, having been used for *Pieridæ*. But *Danaida* and *Danais* are both older than *Limnas*, and there can be no similar objection to them. Mr. Scudder, with his usual conscientiousness, has adopted *Danaida*, the earlier of the two names. But I think his verdict may be reasonably traversed on the ground of the irregular formation of *Danaida* and the universal use of *Danais*. It can hardly be seriously maintained that the latter name cannot be used on account of its resemblance to *Danaus*. So the group obviously remains the *Danaidæ* (or *Danainæ*), the genus *Danais*, and its type *plexippus*,\* *Anosia* falling before it.

Mr. Moore's primary division of the family is into two groups, the *Limnaina*, including *Danais* and *Hestia*, and the *Euploina* including

which seems to vary in different specimens. *Mahintha* was founded on a local race of *Euplœa core*. *E. simulatrix* was placed first in *Vadebra* (*Crastia*) and then in *Menama*, though it obviously cannot come, into either, or into the "section" in which both are placed.

\* The name now applied to a butterfly known to every American farmer as *archippus*. These needless changes of name now so much insisted on, especially by American naturalists, are bringing scientific nomenclature into well-deserved disrepute among all outsiders. Surely there ought to be a statute of limitations; security that some one, turning over musty volumes of pre-scientific times, shall not make all existing works obsolete. At present we stop short at Linnæus. This is purely an arbitrary line. The next generation will perhaps go back to Ray and Swammerdam; with the aid of a little zeal and imagination quite a number of generic names can be found in their books. The first false step taken was the acceptance of Hübner's childish work as an authority. There was *Adolias*, a genus described by such a profound and discriminating writer as Boisduval, and accepted by all naturalists. Finally, some one discovered that a few years before the date of Boisduval's great work, Hübner, a contemporary, not of Linnæus, but of Latreille, had invented a genus *Euthalia*, described merely as "dark with white and red spots," containing *lubentina* and *adonia*, and placed in an imaginary family, prettily named *die Fröhliche* or The Joyful Ones. *E. aconthea*, and *E. evelina* (the latter along with an African *Aterica* and a European *Apatura*) were at the same time placed in different genera of another imaginary family called *die Muntere*, or The Lively Ones. And so, to the confusion of naturalists all over the world, *Euthalia* took the place of *Adolias*. Lepidopterists have yielded to an infinity of similar changes. It remains to be seen whether coleopterists will be equally submissive. Mr. Crotch now proposes to alter the names of a number of the best-known genera of beetles, names consecrated by a century of use. I cannot help wishing his opponents all success in the struggle against *ce malencontreux droit de priorité*, as M. Deyrolle calls it.

*Euploea* and *Hamadryas*. The only difference mentioned, is that in the former there is usually a precostal cell in the hindwing, wanting in the latter. Now, it is true, an obscure rudiment of one is present in some species, but better distinctions can easily be found. *Hamadryas* probably does not belong to this family, but to the *Neotropidae*.\* *Hestia* has undoubted affinities with *Danais* in its venuration and markings, but in its anal tufts, its egg, and the structure of its feet, it is more like *Euploea*, while its antennæ show how remote it is from either. So I would suggest the following classification instead of Mr. Moore's.

*Tarsi with large paronychia and pulvillus.* Anal tufts two or four.

Antennæ filiform, *HESTIA Group.*

„ clavate, *EUPLOEA Group.*

*Tarsi with rudimentary paronychia and pulvillus†.* Anal tufts two.

*DANAIS Group.*

Mr. Butler, to whom we owe the classification of the *Eupleas* by the male marks, accepted, as all previous writers had done, Cramer's *core* as the type of the genus, and formed the genus *Macroploea*, with *elisa* as its type, applying Hübner's name *Orastia* to *climena* and its allies. This arrangement has been generally adopted, and it is most unfortunate that Mr. Moore should alter all three names on what may be called archæological grounds. *Core* has been accepted for a century as the

\* I do not know whether Schatz's name can stand, as it is not derived from that of any genus, and has no type. The name *Erycinidae* has been dropped by some writers for this reason, the generic name *Erycina* having been superseded.

† The appendages of the last joint of the tarsi of butterflies are, 1st, the claws, 2nd, the paronychia, 3rd, the pulvillus with its shield. The *paronychia* are tactile organs, one on each side of the foot, slender and flexible (not jointed as some writers have said), covered with short sensitive hairs or *papillæ*. In most cases they are split into two long finger-like processes, the longer following the course of the claws, the shorter curling round the edge of the pulvillus-sheath, obviously with the object of examining the surfaces touched by these two organs. The *pulvillus* is a soft, muscular projection, resembling an additional tarsal joint, but not armoured like the others. It is evidently intended to act as a buffer, to break the shock of alighting, and no doubt owes its name *pulvillus*, or cushion, to this function. Its lateral surface is sensitive, with papillæ like those on the paronychia. But its lower surface is covered with a round corneous plate, or shield, which no doubt acts as a *sucker*, flexible in life, slightly concave in the middle. This is easily detached in dried specimens.

New in certain butterflies of aerial habits like *Danais*, the claws have been greatly lengthened, so that the pulvillus did not touch the surface on alighting. Thus losing all function, it has shrunk into a small, hard, inflexible mass. The paronychia have similarly lost their use, and remain in various stages of obsolescence. They are still distinct in *Ideopsis*, and retain their bifid shape, though too small to be of use.

type of *Euploea*, and although it would be more pedantically accurate to follow Fabricius rather than Cramer, it seems a pity to confine the use of *Euploea* to two or three species (with their local forms) forming a small aberrant genus, now well-known as *Macroploea*, while hundreds of species cluster around *core* as their natural type and centre. *Macroploea* (Mr. Moore's *Euploea*) is a true genus, and must be ultimately recognized as such. But unless we accept M. Moore's little groups as genera, we must find some general name for the large mass of species remaining. It is unlikely that naturalists will consent to call them all *Crastia*. Surely they had better keep the name of *Euploea* as before, with *Crastia* (= *Vadebra*,\* Moore) as a subgenus under it.

As to the position of the family as a whole, I understand that Mr. Seudder now gives it a low one, below the *Apaturidæ*, *Nymphalidæ* and *Satyridæ*. Much, however, may be said in favour of retaining it at the head of butterflies. The shoulder plates are in most butterflies shaped more or less like a human foot as seen from the side, having a long posterior process. It is only in the *Danaidæ* and the *Acreidæ* that they are simply semicircular in shape (in the *Danaidæ* more than half a circle) without the posterior process. The process is also greatly reduced in *Cynthia* and *Cethosia*, the nearest genera of the *Apaturidæ*, while in the lower forms of the *Tetrapoda*, the plate greatly resembles that of other butterflies. The long claws of the *Danaidæ*, culminating in *Danais* with its aborted paronychia, may also show a higher development than other *Tetrapoda*. But they are also found in the *Papilio*, and seem to go along with a prolonged and aerial flight. The fore-feet of the male still retain the tarsus, which is lost in most *Neotropidæ* (*Ithomiadæ*), but it is less developed than in the *Morphidæ* and most other higher butterflies.

The striking feature of the *Danaidæ*, however, is the more perfect development of the fore-feet of the female into sensory organs much resembling the antennæ, but set with highly specialized tactile hairs or papillæ.† I have taken a good many notes on this subject, on which so far as I know nothing has yet been written, and when they are more complete, I hope to publish them. So far as examination has yet shown me, there seems to be a gradual development upwards from the *Morphidæ*, in which the joints are tapering, the last the slenderest, with a conspicuous pulvillus and rudimentary claws with their appertaining hairs. In the higher groups, these tarsi become less and less like a foot, and

\* Mr. Moore applied this name to two different genera of butterflies in the same issue of the Proceedings of the Zoological Society.

† These also occur in all *Tetrapoda*, and in some other groups, as the *Nemeobidæ*, but are there few and small.



more and more like a palpus. The *Satyridae* and *Nymphalidae* are more developed in this respect than the *Morphidae*, and the *Apaturidae* much more. The *Neotropidae* according to Mr. Godman have the fore-tarsi of the female not clavate, and hence probably less developed. In the *Danaidae* and the nearest *Apaturidae* (*Cethosia* and *Cynthia*), they attain their largest development. This can hardly be an organ of touch, because these feet are poorly provided with muscles, and are capable of but little movement. It may be an organ of hearing, but it is more likely one of smell, correlated with the scent-producing glands of the male. It is significant that in the *Neotropidae*, where this foot is more normal, the male has no anal tufts.

I think the special development of this organ, which is found in all Tetrapod butterflies, though but little specialized in the lowest, is an argument for the high rank of the *Danaidae*. But I am aware that the feet of butterflies often vary most irregularly, independently of the general organism. The aborted forefoot of the male shows some such inconsistencies, rudiments being, as Darwin has shown, eminently variable. *Melanitis* and *Bleogona* in the *Satyridae*, many *Pieridae*, and at least one genus of the *Lycænidæ* have the claws bifid. The number of joints in the forefeet of female Tetrapods also varies. And in *Pseudergolis*, a genus of the *Apaturidae*, differing but little from its neighbours in other points, the fore-tarsi of the female, though small, are quite perfect, with claws, pulvillus and bifid paronychialia. This fact would place it quite outside of the Tetrapod butterflies, near the *Nemeobiadæ*, if the feet offered really reliable characters.

The prehensors of the *Danaidae* are chiefly remarkable for the aborted uncus and the broad flat clasps. They do not vary much in the different species; most in *Hestia* and some kinds of *Danais*. My notes are insufficient to permit me to generalize on the subject. It is remarkable that the only species in which they are really very aberrant is *Danais aglaoides*, where the clasps are prolonged downwards, and exposed to view even in dried specimens. This butterfly is closely allied to *D. aglaia*, differing chiefly in the shape of the wings, and they are found together over much of their range. It seems likely that in this case the prehensors have been strongly differentiated to prevent hybridism, and keep the species separate.\*

\* This may also be the case with the genus *Lampides*, where a number of protected species, remarkably alike in colour and markings, have the prehensors extremely unlike, and so differently armed with hooks and pincers, that the union of different species would presumably bring about serious consequences. Great confusion has been caused here by the German lepidopterists, who have recently figured a great many species with very brief descriptions, and no account of the prehensors. The

The egg also varies little in the *Danaidæ*, and affords few characters for classification. It is slightly like that of *Libythea* (which more resembles that of the *Pieridæ*), and is nearly identical with that of the *Acræidæ*, and with those of *Cynthia* and *Oethosia*, the first genera of the *Apaturidæ*, which are again connected by several links with *Argynnis*, where the series seems to end. In the *Danaidæ* it is large, soft, cartridge-shaped, more than half again as high as wide, yellowish, or sometimes pearl white. It has a variable number of upright ribs anastomosing near the apex (where the reticulations are more or less hexagonal over a varying extent of surface), and with horizontal cross-lines varying greatly in number and in distinctness, and generally hard to count. I append a list of species with the number of vertical ribs on the egg of each, and with that of the cross-lines in parenthesis, whenever I know it. The numbers always vary slightly in the same species, and that of the cross-lines can only be given approximately. The egg of *Nectaria* and *Macroploea* I forgot to examine. That of *Hestia* is unlike the others in having the reticulations more or less hexagonal, the ribs being slightly zigzag. The figures support the idea that *Hestia* is nearer *Euploea* than *Danais*. It will be observed that in *Danais* (including *Ideopsis* and *Radena*, which are practically identical) the cross-lines are usually more numerous than the ribs, while in *Hestia* and *Euploea* they are fewer, *Stictoploea* coming near *Hestia* in this respect, as well as in the anal tufts. The figures for *Danais chrysippus* and perhaps *limniacæ* and *tytia* are doubtful.

|                |                                  |                         |
|----------------|----------------------------------|-------------------------|
| HESTIA Group.  | <i>Hestia cadellii</i> ,         | 21 (14).                |
|                | <i>hadonii</i> ,                 | 23 (14-15).             |
|                | <i>lynceus</i> ,                 | 21 (14).                |
| EUPLOEA Group. | <i>Stictoploea lacordairei</i> , | 27 (13).                |
|                | <i>Salpinx novaræ</i> ,          | 26.                     |
|                | <i>kollarii</i> ,                | 22-23 (20).             |
|                | <i>splendens</i> ,               | 22 (18-19).             |
|                | <i>Euploea esperii</i> ,         | 26.                     |
|                | <i>camorta</i> ,                 | 31.                     |
|                | <i>simulatrix</i> ,              | 30.                     |
|                | <i>core</i> ,                    | 34 (23-25).             |
|                | <i>midamus</i> ,                 | 24-25 (20).             |
|                | <i>alcathoë</i> ,                | 39 (26-27).             |
|                | <i>rhadamanthus</i> ,            | 21-23 (15).             |
|                | <i>pinwillii</i> ,               | 26 (18).                |
|                | DANAIS Group.                    | <i>Danais genutia</i> , |

revision of this genus, which is further complicated by the prevalence of local and seasonal forms, will prove a heavy task to future naturalists.

|                            |                     |
|----------------------------|---------------------|
| <i>Danais hegesippus</i> , | 31-34 (29-30).      |
| <i>nesippus</i> ,          | 34.                 |
| <i>chrysippus</i> ,        | 34 ("nearly 50" ?). |
| <i>gautamoides</i> ,       | 23-24.              |
| <i>limniace</i> ,          | 25 (25).            |
| <i>septentrionis</i> ,     | 19-21 (30).         |
| <i>melaneus</i> ,          | 16-18 (27).         |
| <i>larissa</i> ,           | 20-21 (30).         |
| <i>tytia</i> ,             | 20-21 (38).         |
| <i>melanoleuca</i> ,       | 19 (22).            |
| <i>aglaia</i> ,            | 17 (26-27).         |
| <i>aglaioides</i> ,        | 15-16 (25).         |
| <i>Ideopsis daos</i> ,     | 15 (25).            |
| <i>Radena nicobarica</i> , | 16.                 |
| <i>vulgaris</i> ,          | 14-16 (25).         |

Next comes the vexed question of scent-glands. I was so discouraged by the loss of all my notes on this and other structural matters in 1887, that I have taken but few since, so I cannot now speak with much authority on the subject.

It seems probable that there is a disagreeable odour in all *Danaidæ*, apart from that of the anal tufts and alar glands. Though infinitely less in strength than it is in the *Agaristidæ* and other moths, it is still quite perceptible on pinching some species, such as *Danais genutia*, *crocea* and *vulgaris* (which smells of sorrel). In others I cannot make it out at all. This smell is probably associated with a taste highly disagreeable to spiders, chickens, etc. The results of my experiments made some years ago in the Celebes, Java, etc., are now lost, but in the Malay Peninsula I lately made a few on spiders, with the following results. Except in the case of the first two species, they cannot be entirely trusted.

Species always rejected, *Danais genutia*,  
*Radena vulgaris*,  
*Ornithoptera ruficollis*,  
 (only two offered).

Species sometimes rejected, *Euplœa midamus* ;  
 „ *rhadamanthus*,  
*Neptis varmona*,  
*Cethosia hypsina*,  
*Loxura atymnus*,  
*Lampides ælianus*.

Species never rejected, *Neptis* sp.  
*Athyma* sp. etc.

It is to be observed that the *Radenæ* are perhaps the most perfectly

protected of the *Danaidæ*, and yet they are not brightly coloured, they have no alar scent-glands, and the anal tufts are the smallest in the whole family, and give the least fragrance.

Apart from those producing the odour pervading the whole body, four different classes of scent-glands have been pointed out.

The first are the impressed silky streaks of altered scales on the forewings of some *Euplœas*, often called *brands*. Mr. Distant oddly enough calls these pseudo-scent-glands, taking the falsity of their claims for granted, while assuming to leave the question open. The marks in question seem to consist of scales only, and I have not yet observed any glands connected with them. Though not very conspicuous in some cases, they may be addressed to the eye of the female, and help her to recognize the male of her species. For odours vary but little in the *Euplœas*, and the amount of mimicry is so great that in most localities there are several species similarly coloured but bearing different sex marks. In any case these brands can hardly be protective, and the assumption by some writers that a species furnished with them is better protected, and more likely to be a mimicked than a mimicking form, is without foundation.

The variously-coloured velvety patches on the hindwing of *Trepsichrois*, *Salpinx* etc., are no doubt true scent-organs. In the case of *Trepsichrois midamus* the odour is sometimes quite perceptible in the detached hindwing, while in *Salpinx* and *Calliplexa* it is apparently excited by friction against the forewing. In some cases, such as *Euplœa oceanis*, described below, the velvety area is on the underside of the forewing.

The "pouches" on the hind-wings of certain species of *Danais*, such as *D. limniace*, are probably true scent-organs, though neither Professor Wood-Mason, who has given them special attention, nor myself, have been able to detect any odour. He has kindly shown me a microscopic section of the pouch. The cavity is lined with a semi-circle of long cylindrical cells radiating from it, their nuclei near their inner ends, the outer wall of the mass thick and chitinous, the inner membranous, with the attached scales aborted. According to Professor Wood-Mason, the odour-giving fluid is presumably manufactured in these cells, and not merely drawn from the body and stored in them. An account of these pouches, apparently made from the study of dried specimens, has appeared in the work on the "Duftapparate indo-australischer Schmetterlinge," by Dr. Erich Haase of Dresden.

Finally there are the abdominal tufts which we find in this family alone of all butterflies. They resemble those of the *Callitulidæ*, but are more specialized, though proportionately smaller than in these and

many other moths.\* They exist in a very rudimentary state in the female, and can as in the male be forced to the surface by the action of the fluids in the body. From some such small beginning, they have grown to their greatest development, several stages of the process remaining as fixed characters in the different genera. The smallest tufts occur in *Radena vulgaris*; they are much longer in *R. juvena*. The greatest development of simple tufts occurs perhaps in *Euplœa* (*Trepischrois*) *midamus*. In all the species of the *Danais* group the tufts are simple and single, only in *Tirumala* the hairs are curled at the tips. They are also simple in the majority of the old genus *Euplœa*, and I limit the name to these. The gland in all these consists, when protruded, of a finger-like projection extending laterally on each side of the abdomen, and bent round forwards (*i. e.*, towards the head) in a semicircle, bearing long odoriferous hairs to the very tip.

But in the genus *Salpinx*, as limited by Mr. Butler (including Mr. Moore's *Salpinx*, *Isamia*, *Pademna*, *Satanga* and *Selinda*, but not apparently *Danisepa*), and also in his genus *Calliplœa*,† while the gland is similar (somewhat longer and more bent), the long hairs are gathered chiefly around its base, the outer part being naked, except at the extreme tip, where there is a brush of short, stiff bristles, sometimes coloured differently from the long basal hairs. This terminal brush is only seen when the gland is fully protruded. The development of this form from the first is obvious. This group is also large, but the number of species seems to me to have been greatly exaggerated.

In more advanced forms, a new gland, generally somewhat shorter than the other, has been pushed out from its hairy base on the anterior side. In this case both glands are covered with hair to the tip, the space between their bases being naked. This occurs in the genus *Hestia*, and apparently also in *Macroploœa* and *Stictoploœa*‡ as defined by Mr. Butler.

Finally in the single genus *Nectaria*, while the posterior tuft remains unchanged, the anterior or last developed one is again absorbed, and is represented by a microscopic tuft at the base of the other. This can hardly be the incipient stage, as it is too small to be of any use, and the nature of its origin is obviously as given above. It hence appears

\* In most moths these tufts are attached to the prehensors or clasping-organs of the male.

† Herr Georg Somper and Dr. Haase consider *Calliplœa* identical with *Euplœa* (*i. e.*, *Macroploœa*), but I cannot agree with them. *Calliplœa* scarcely differs from *Salpinx*.

‡ My drawings of the glands of *Macroploœa* and *Stictoploœa* were lost in 1887, and I have not examined those organs since. But my impression is that they are very similar to those of *Hestia*, though somewhat less developed.

that *Nectarina* has attained the furthest development in this regard, and may still with good reason be retained at the head of the *Danaidæ*, and of all butterflies.

The following scheme will serve to show the relations of the genera of this family. Mr. Moore's genera may be reduced to subgenera, though *Parantica* and perhaps one or two others may be retained.

- A. Feet with well-developed paronychia and pulvillus.
  - B. Forewing with a prediscal cell.
    - C. Anal glands four, two aborted, ..... NECTARIA.
    - C. Anal glands four, none aborted, ..... HESTIA.
  - B. Forewing with no prediscal cell.
    - C. Glands four (?), none aborted.
      - D. Forewing of male with no brand, ... MACROPLÆA.
      - D. Forewing of male with two brands, ... STICTOPLÆA.
    - C. Glands two, tufts four, ..... SALPINX.\*
    - C. Glands two, tufts two, ..... EUPLÆA.
- A. Feet with rudimentary paronychia and pulvillus.
  - B. Hindwing triangular, with scent-pouches, ..... DANAIS.
  - B. Hindwing triangular, without scent-pouches, ... RADENA.
  - B. Hindwing rounded, generally without scent-pouches, ..... IDEOPSIS.

There seem to be grounds for believing that the scent-tufts in the male serve three distinct purposes, 1st, to warn off enemies, 2nd, to attract the female by colour, 3rd, to attract her by odour.†

1st. The odours given forth are in some cases unpleasant. In *Danais limniace*, it is that of turmeric, and is downright disagreeable. Other species of *Danais* have the peculiar aromatic fragrance characteristic of so many protected Mediterranean plants. In the genus *Salpinx*, in which the tufts reach their greatest development in size, the odour, though exceedingly sweet, is almost overpowering. Now it may at first sight seem absurd to say that the scent of honey may protect an insect from its enemies. But we know this to be sometimes the case. The male of the singular Hesperian, *Calliana pieridoides* has assumed conspicuous white colours along with a delicious odour, the female remaining dark and odourless.‡ The fine Malayan Morphid,

\* Including *Calliplœa*.

† The odour is not always present, but comes and goes, whether by the exhaustion of the supply, or by the will of the insect, it would be interesting to learn. I have sometimes examined the tufts of several males one after the other, without detecting the perfume.

‡ Mr. de Nicéville recently discovered the female, and it turned out to be dark, as I had predicted.

*Melanocyma faunula*, is saturated with sweet perfumes, and drifts feebly about the country, fearless of enemies. The fragrant butterflies of the genera *Stichophthalma* and *Tanaris*, though no doubt not so completely protected, are so conspicuously coloured and fly so feebly, that one cannot suppose them to be eaten by birds. The *Ornithopteras*, though I have shown by experiment that they are protected from some enemies, smell of nothing worse than petunias. I have heard that cattle will not touch peppermint or pennyroyal, though the scent of those plants is so pleasant to us. On the whole I do not doubt that slow-flying, brilliantly-coloured insects like *Trepsichrois* and *Salpinx* are more or less protected by their scent-tufts.

2nd. Colour in the tufts seems a later development than odour. In *Radena*, where they are least developed, the tufts are of very inconspicuous hues. In *Danais* they are usually not at all brilliant, though it must be admitted that the odours are also less developed in these. But in some species the hairs are curled,\* and this may be an ornamental development. In the *Euploas* the growth of colour and odour go on *pari passu*. The brilliant ochreous tufts of *Trepsichrois* contrast finely with the black and shining blue of the wings, and are visible from a long distance. This colour appears in a great many species. In *Salpinx* the tufts are still larger, and the small terminal pair are frequently coloured differently from the others. In *Hestia* the anterior tuft seems usually coloured otherwise than the posterior, though in *H. cadellii* they are both dull grey.

3rd. The great majority of the family smell of honey or of flowers—vanilla, tuberoses, jasmine, etc., and outside of the *Danais* group, the only aberrant perfume I can remember is that of winter-green,† which is also found in butterflies of other families, and in Pyralid and Geometrid moths. But honey- and flower-like smells are the rule. This suggests the possibility that the odour-producing particles may not be manufactured by the insects, but be derived directly from the plants they frequent. At any rate the attractive scent must often be identical with that of the flowers on which they feed. So that it does not seem incredible that the female should sometimes be wooed under false pretences, and led to expect a dinner instead of a lover.

Male *Euploas* often meet in great swarms, haunting some particular spot in the forest for many successive days, some perching on leaves and flowers, but most circling slowly around, many of them displaying their tufts, so that the air is noticeably permeated with their fragrance. Many different species meet on these occasions, as if recognizing the

\* This is also the case with a few *Euploas*, such as *alcathöë*.

† The same smell is given out by several tropical plants.

family relationship of all. The females may at the same time be lurking hard by in the jungle, though in smaller numbers, a few of them sometimes joining in the flight of the males. I have often observed males flying alone with expanded tufts, and I suppose they are trying to attract the female from a distance, appealing rather to her sense of smell than that of sight. In the presence of the female, the male keeps his tufts in continual action, and whether of dark or bright colours, they may well be as attractive to her eyes, as the plumes of the cock grouse or peacock are to his hens. The eyes of butterflies are so prominent, that though the female never faces the male, but keeps gliding on just before him in coy retreat, I cannot think that any grace of his escapes her notice. But her sight is probably not so strong as to recognize these ornaments at a great distance. So that the attractive colours are presumably intended to take effect at close quarters only, while with a favourable wind the odour is no doubt perceptible far away. I myself cannot generally make it out more than two or three feet away. But the forefeet of female *Danaïdæ* seem to be developed into a powerful organ of smell, and even apart from this, that sense must be keen in all butterflies, since they are attracted from long distances by the scent of flowers. And few flowers are so fragrant as these insects.

#### *List of Enganese Butterflies.*

##### Family DANAIDÆ.

1. NECTARIA LEUCONOË, Erichson, var. ENGANIA. This slight variety seems darker than the typical *N. leuconoë*, as figured by Doubleday, just as *N. clara* (as figured by Herr Semper) is much lighter. The base is but slightly touched with creamy, and more so in the female than in the male. The dark lines in the cell of the forewing are distinct, the black transverse area there narrower and more quadrate than in *leuconoë*, the discal dark markings are more connected, and those on the hindwing are more triangular, the wedge-shaped white spot near the lower angle of the forewing is distinct, and in general the markings are very clearly out and distinctly outlined. The male has two large whitish abdominal tufts, each with a minute rudiment of another near its outward base.

2. MACROPLŒA CORUS, Fabricius, var. MICRONESIA. Somewhat resembling *M. corus (elisa)*, with the size and shape of *M. phœbus*. Male, forewing with the spots minute, one in the cell, seven in a bent discal series, and ten submarginal dots. Hindwing with two or three discal, and one or two subapical dots. *Below*, forewing with a dot in the cell, two large discal spots with a dot below them, two subapical dots, and



a submarginal row of thirteen dots. Hindwing with three discal dots subapically, and four or five submarginal ones. The single female has the spots still fewer and less conspicuous, the submarginal ones wanting except at the apex.

As I took only two or three specimens, I can hardly describe this form as a distinct species. It seems greatly to resemble *M. semicirculus* from the Moluccas. The extreme smallness of the spots easily distinguishes it from *M. pharetena*, described by Herr Kheil from Nias. *M. pharetena* (the name was perhaps intended as an anagram of *phanarete*) seems to be simply the female of *M. phœbus*, which he also includes in his list of Nias butterflies.

3. *SALPINX PHANE*, n. sp. Male, above rich velvety blue, resplendent in some lights, the hindwing nearly equally brilliant, whereas in *S. novaræ* and *S. vestigiata* it is all brown. Forewing, with one costal and the usual interno-median pale blue spot, and a row of seven outer-discal ones, of which the first three are united, the third the largest. Hindwing generally with two subapical spots. *Below*, rich violet brown; the spots are sometimes wholly wanting in both sexes, but generally one or two remain subapically on the hindwing. The male before me has five subapical spots in two series on the forewing and four larger ones on the hindwing. The larger tufts are dark brown, the small terminal ones whitish. The female is less richly coloured, the hindwing being brown: there are two elongate blue spots in the interno-median space of the forewing above.

This is a local form of *S. leucostictos*, Gmelin, but it seems more distinct from the Javaeso type than are either the Malaccan (*vestigiata*) or the Nicobarese (*novaræ*) forms.

4. *EUPLŒA (TREPSICHOIS) MALAKONI*, n. sp. Male like *E. mulciber* but with the hindwing blue like the forewing, though less brilliant, whereas in the other species it is brown. The odoriferous patch on the hindwing occupies all the end of the cell, extending to the upper median vein. The pale blue spots of the forewing, though variable, are few and inconspicuous; in the specimen before me there are only nine in all, some very minute. The female varies greatly in the distinctness of the spots, but in all cases the forewing has no trace of blue, which distinguishes it from the other local forms of *E. midamus*. Tufts bright yellow.

5. *EUPLŒA (CRASTIA\*) ENGANENSIS*, n. sp. It greatly resembles

\* Mr. Moore's *Vadebra*.

*E. climena* from the Moluccas, and is near *E. sepulchralis*, Butler, from Java, but with the forewing imperceptibly paler outwardly, while the hindwing is very distinctly so, both above and below. Both sexes are rich brown above, without any trace of blue; the female has a single whitish spot in the middle of the disc. *Below*, there are usually on the forewing, one large violet-white spot in the cell, two or three subapical dots, two submarginally in the median spaces; five discal ones, the lower two larger and quadrate, the middle one slender, the upper two usually minute. *Hindwing* with one spot in the cell, a semicircle of six beyond it, then a curved series of about eight, (those below the middle median vein minute or wanting), and four submarginal spots near the apex, occasionally five or six. Tufts bright ochre.

This common species outwardly resembles *Euploea simulatrix*, Wood-Mason, from the Nicobars, which, however, has a large sex-mark, somewhat as in *Salpinx*, on the hindwing above. Mr. Moore placed this species first in *Vadebra* (*Crastia*) and then in *Menama*, where it certainly does not belong.

6. *EUPLOEA* (*CRASTIA* ?) *OCEANIS*, n. sp. Male. Above dark brown with dull bluish reflections in some lights, the margin not visibly paler. *Below* uniform dark violet-brown, the markings varying greatly, most of them elongate but small. Forewing with one spot in the cell and seven beyond it, the upper ones slender, sometimes minute; a line of five outer-discal spots, the upper ones frequently absent; the female has sometimes a sixth spot in the interno-median space, beyond the line of the others. Hindwing with a small spot in the cell, and a row of 6-7 larger ones beyond it, and then a very variable series of 5-10, all but the first (which is sometimes absent) forming nearly a straight line: beyond these there are generally a few submarginal dots, sometimes forming an irregular line of ten.

The female has an obscure whitish spot in the cell of the forewing above, and seven similar ones beyond it, the upper ones slender. Beyond this the outer discal spots are slightly indicated. Hindwing with the outer discal line of spots indicated in various degrees.

The form of the wing in this species is as in Mr. Moore's genus *Gamatoba*, but the sex-mark is peculiar. The female has an elongate white mark on the underside of the forewing, below the lower median vein. Both sexes have the hind margin broadly whitish and shining below the internal vein. In the male there is a slightly velvety grey-brown patch of altered scales forming an elongate, quadrate mass, from the internal vein nearly to the lower median, equally divided by the wrinkle representing the submedian vein.

This species can scarcely be included in any of Mr. Moore's subgenera, and I know no described form resembling it. It was unluckily out of season when I was in Engano, and I only got two or three in fair condition, the rest being worn and faded.

7. *EUPLOEA PAHAKELA*, n. sp. Male, above, forewing rich brown, not at all lighter outwardly; hindwing paler brown, slightly darkening near the margin; a single "brand" like that of *E. core*; no other markings above in either sex. *Below* there is a rounded violet white spot in the cell, and a larger pinkish one in the lower median space, one in the upper median space, and sometimes one in the space above. Hindwing with a small spot in the cell, and 3-5 minute ones beyond it. There are sometimes traces of obscure subapical and subanal dots. Tufts bright ochre. The female is very pale brown and remarkably translucent; it has a long white streak below the lower median vein on the forewing below.

This species seems to have no near allies except *E. camorta*, Moore, from the Nicobars, which obviously differs in the pale borders of the wings.

Besides the *Euploëas* mentioned, I believe I saw a species of *Calliploea*, near *mazares*, flying at Kayapu on the day of my arrival.

The *Euploëas* of Nias, as described by Herr Kheil, differ greatly from those of Engano; there can hardly be more than one species (a *Salpinx*) common to both. I append the list.

| Nias.  | Engano.                                  |
|--|--|
| <i>Macroploëa phœbus</i> .                                       | <i>Macroploëa micronesia</i> .           |
| „ <i>phœretena</i> (♀ of preceding?)                             |  |
| <i>Euploëa (Tronga) niasica</i>                                  | .....                                    |
| „ ( <i>Trepsichrois</i> ) <i>verhuelli</i> .                     | <i>Euploëa (Trepsichrois) malakoni</i> . |
| „ ( <i>Penoa</i> ) <i>menetriesii</i> .                          | .....                                    |
| .....  | <i>Euploëa (Crastia) enganensis</i> .    |
| .....  | „ „ <i>oceanis</i> .                     |
| .....  | „ <i>pahakela</i> .                      |
| <i>Salpinx leucostictos</i> (perhaps the same as <i>phæne</i> ). | <i>Salpinx phæne</i> .                   |
| „ ( <i>Isamia</i> ) <i>lowii</i> .                               | .....                                    |
| „ „ <i>staudingerii</i> .  | .....                                    |
| „ ( <i>Tiruna</i> ) <i>ochsenheimeri</i> .                       | .....                                    |
| .....  | ? <i>Salpinx (Calliploëa) sp.</i>        |

The absence of the true *Euploëa* (*Core* group) and of *Crastia* (*Olimena* group) from Nias, and of *Tronga* and *Isamia* from Engano, are interesting.

8. *DANAIS PIETERSII*, n. sp. Pl. I, Fig. 1. Male and female, above black, forewing with the lower part of the cell, the basal part of the lower median, and the greater part of the interno-median space dull ferruginous, the veins black. Margin touched with white at intervals; a line of four submarginal white dots in the median spaces; another larger and diffused near the lower angle; an inner line of seven white marks, of which the pair in the upper median space is of some size, the other dots: a subapical band of six widely-separated diffused whitish spots from the costa, the lower two largest; below these two obscure spots in the upper median space. *Hindwing* black, a large, pale ferruginous area in the cell, and others in the submedian and internal spaces extending three-fourths towards the margin; shorter, slender ferruginous streaks in the other discal spaces: two lines of submarginal whitish dots mostly obsolete, more distinct in the median spaces; cilia alternately black and white. *Below*, similarly marked but with the spots more distinct and numerous and violet-white instead of whitish; the lower part of the forewing ferruginous, the apex, as well as the outer part of the hindwing, suffused, with dull, dark reddish, which takes the place of the black. *Hindwing*, with pale ferruginous areas in all the spaces, most of them bordered with silvery white, the veins dark; the two submarginal series of the white spots distinct and complete. In some specimens the cell is nearly white, the inner ferruginous area evanescent.

I am not able to compare this species with *D. eurydice* from Nias, but judging from the forms with which Mr. Butler compares it, that species is without the ferruginous areas on the hindwing above.

I name this for my kind friend Mijlheer Pieters, Controleur of Kroë in Sumatra. It is a common and conspicuous species in Engano, whereas Herr Kheil describes *D. eurydice* as rare in Nias.

9. *DANAIS (BAHORA) CHIRYSEA*, n. sp. Pl. I, Fig. 3. A local form of *D. philomela* from Java, differing in the subapical spots being more elongate, and in all the markings of the forewing being yellow except the two outer series, the yellow area of the cell heavily clouded with black scales except at its lower angle, in this resembling *D. crocea*. The interno-median yellow area shows is divided by a line of black scales in the middle, the quadrate discal spots are partly joined, as in *crocea*. *Hindwing* marked as in *crocea* and coloured as in *philomela*. The wings are very long and narrow. The female has the yellow area more restricted, all the spots larger and more conspicuous.

I think I saw *Parantica aglaia*, or its representative, on the day of my arrival at Engano, but no specimens were taken.

10. *RADENA LONGA*, n. sp. Pl. I, Fig. 2. A local form of the Javanese *R. juvena*. Forewing very long, falcate, the white markings mostly elongate and reduced, cell of forewing with the basal mark slender, clavate at tip, the outer one small with the upper streak absent, the discal spots beyond the cell much reduced. Hindwing, with the white area in the cell broken by two dark lines, the upper wide, the lower slender, not quite continuous; all the discal spots beyond the cell slender and elongate.

11. *RADENA MACRA*, n. sp. Pl. I, Fig. 4. A local form of *R. vulgaris*, the forewing elongate (but shorter than in *R. longa*), falcate, cell with the basal mark bifid, the upper streak slender, not so long as the lower, the outer spot narrow at its upper end, with a minute spot adjoining it above, and without the slender prolongation present in *R. vulgaris*; the three spots beyond the cell greatly, and all the others more or less reduced in size. Hindwing with all the spots reduced, that in the cell simply bifid, without any spot in the bifurcation (such as occurs in *R. vulgaris*). The submarginal dots are wanting on the apex of the forewing above and below.

These two *Radenas* are about equally common, and are found together. In the island of Sembawa, east of Java, two *Radenas* also occur, but in this case the *juvena* form is restricted to higher altitudes, though there is a zone in which both are found. These facts surprised me as I had supposed *juvena*, like *vulgaris*, to be simply a local form of *R. similis*.

The anal tufts of *R. vulgaris* and *macra* are shorter than in any other Danaid, the hairs white at the base and grey outwardly. In *R. juvena* and *longa*, they are nearly twice as long and grey throughout.

All the Enganese species of *Danais* are distinguished by their elongate form. This is also the case with several groups of butterflies in the Celebes, as shown by Mr. Wallace.

#### Family SATYRIDÆ.

12. *LETHE EUROPA*, Fab. scarce.

13. *MELANITIS LEDA*, Linn. (*ismene*). My specimens were dark and nearly unmarked above, but of the usual shape. Both the ocellate and the non-ocellate forms were taken.

14. *MYCALESIS MINEUS*, Linn. Common.

#### Family ELYMNIADÆ.

15. *ELYMNIAS DOLOROSA*, Butler, var. *ENGANICA*. A local form of

*Elymnias panthera*, Java, resembling *dolorosa*, as described by Mr. Butler from Nias. The forewing, however, is scarcely paler outwardly, its lower angle generally suffused with reddish; the ocelli of the hindwing are placed in diffused pale spots. Underside with two or three minute ocelli on the forewing, and six on the hindwing the first nearly all white, the others blue with the outer end dark and the pupil white. The outer part of the wing is but slightly paler than the inner, and is not "stone yellow striated with blackish" as in *dolorosa*, but pale grey-brown with red striæ similar to those of the base. *E. dolorosa* has the hindwing more strongly dentate than in *panthera*, with a decided tail, but in the Enganese form the tail is much less distinct than in *panthera*. I took only females. The sex of the type of *dolorosa* is not stated.

#### Family MORPHIDÆ.

16. *AMATHUSIA AMYTHAON*, Doubleday, var. *INSULARIS*. Above black, the disc glossed with blue in some lights up to the border of the hindwing, but not apically on the forewing, the marginal line white. The lilac band is somewhat intermediate between that of *A. portheus*, or *dilucida*, and that of *A. westwoodii*, tapering less than in the latter, extending down to the internal, and up to the upper median vein near the outer margin, very broad costally. Below, the extensive space beyond the middle striga of the hindwing almost to the submarginal line is dusky in both sexes, without the lilac gloss of the rest. On the forewing there is a smaller dusky patch chiefly costal, beyond the fifth striga. These dark spaces are scarcely visible in the allied forms. The underside seems generally darker than in *westwoodii*, the ocelli have broader dark borders, the tails are much broader and more marked with white than in any other variety; the anal black spots are touched with blue in both sexes.

The ochreous band of the female is narrow, bifid near its lower end, deeply incised outwardly along the middle median vein and partly enclosing a dark spot in its inner margin above the same vein.

One of the numerous local forms of *Amathusia amythaon*, which are by some held as species. I am unluckily unable to compare it with Felder's Javanese varieties. It differs from *portheus* and *dilucida* in the broad tails and narrower blue band. It is like Westwood's *amythaon* (now called *westwoodii*), of uncertain habitat, but the band is less tapering, broader outwardly, the tails much broader, and the outer margin of the forewing convex instead of concave.

#### Family APATURIDÆ.

17. *CUPHA ERYMANTHIS*, Drury.

18. *ATELLA ALCIPE*, Cramer. The specimens are quite normal. Herr Kheil mentions *Atella phalanta*, and not *alcippe*, as occurring in Nias, possibly a mistake.

19. *CYRESTIS PERIANDER*, Fabr. Resembles the Malaccan form (*themire*, Honrath), but still darker, much darker than the Tenasserim one, which is perhaps a distinct variety. I have not seen the Javanese form, but if Horsfield's drawing is correct, and the insect has only the single space between the two outermost ochreous bands white, *themire* may be considered a distinct species.

A common species in the high forest.

20. *PRECIS IDA*, Cramer. Only one taken.

21. *HYPOLIMNAS BOLINA*, Linn. The male is normal, the female infinitely variable. Occasionally it is not much unlike the male. Usually the bluish band across the forewing is obscure and there are traces of a reddish band from the disc of the forewing across the hindwing, with white discal spots beyond it. The white band across the forewing below is present or absent. Sometimes this form resembles *Danais pietersii* when flying. Mr. Woodford has given an interesting account of the variability of the female of this butterfly in the Solomon Islands.

22. *HYPOLIMNAS ANOMALA*, Wallace. My single male, taken at Malakoui, has only the costa and outer margin of the forewing purplish, with an outer-discal line of white spots on both wings, a submarginal line, and a few discal streaks. The hindwing has no white on the disc. No doubt the species is as variable in Engano as elsewhere.

23. *DOLESCHALLIA NIASICA*, Butler. I took two or three males which may be conspecific with the female described as *niasica*. They are much darker than males of *D. bisaltide*, the apex of the hindwing strongly suffused with black. Herr Kheil gives both *niasica* and *bisaltide* from Nias, apparently considering them distinct, but it is unlikely that two varieties so closely allied can be found together. I have recently taken typical *Doleschallia pratipa* and typical *polibete* in the same piece of jungle in Western Siam, but this is a case of two local forms overlapping at the limit of their ranges. The same is true of *Parthenos lilacinus* and *gambrisius* from Karenni to Lower Siam.

#### Family NYMPHALIDÆ.

24. *NEPTIS SOMA*, Moore, var. *MERIDIÆ*. Smaller than the Indian variety, and darker below, the markings of the upperside somewhat smaller and less fuliginous.

25. *NEPTIS OMBALATA*, Kheil, var. *ENGANO*. Like the Nias form described by Herr Kheil, but on the upperside the subapical white spots are smaller and better separated, the two lines of submarginal lunules distinct, and the upper white band of the hindwing much narrower and more broken. The colour of the underside is a rich red-brown, and the black borders of the white bands are very conspicuous.

Family LYCÆNIDÆ.

*Subfamily Aphnevinæ.*

26. *HYPOLYCENA THECLOIDES*, Felder. This butterfly occurs locally in the Nicobars and the Malay Peninsula, and seems to feed on some shore-plant. It seemed scarce in Engano.

27. *EOÖXYLIDES THARIS*, Hübner. Common in the forests of the interior. The specimens are smaller than Sumatran ones, with the inner black fascia of the underside obsolescent.

28. *BINDAHARA SUGRIVA*, Horsf. Only two males taken, both quite normal. Herr Kheil mentions *B. phocides* in his Nias list, probably by mistake. I have taken *sugriva* in Great and Kar Nicobar, and again in Java.

*Subfamily Deudoriginæ.*

29. *DEUDORIX EPIARBAS*, Moore. The cell of the forewing is touched with red in the female.

*Subfamily Lycæninæ.*

30. *NACADUBA ARDATES*, Moore. Common.

31. *NACADUBA VIOLA*, Moore. Only one or two seen.

32. *NACADUBA PROMINENS*, Moore. Scarce.

33. *NACADUBA MACROPHALMA*, Felder. Scarce. None of these species are mentioned as occurring in Nias, but Herr Kheil's *Plebeius kupu* is apparently the female of *N. viola*.

34. *CATOCHRYSOPS STRABO*, Fab., var. *LITHARGYRIA*. I think the true *strabo* was also seen, and no doubt *C. pandava* and *cneius* also occur. These species all seem to feed on a leguminous plant growing on the seabeach, and are found on many small islands. *Catochrysops pandava* is per-



haps the commonest butterfly of the Nicobars. Herr Kheil mentions only *C. strabo* and *cneius* from Nias, and also *C. kandarpa* (= *strabo*).

35. EVERES PARRHASIUS, Fab., (stated by Mr. de Nieéville to be the same as the European *argiades*). Only one or two seen. This is Herr Kheil's *Plebeius polysperchinus*.

36. LAMPIDES BOCHUS, Cramer, (*Jamides bochus*). My specimens were identical with Indian ones. The species seems to vary but little throughout its range. The Nicobar form seems perfectly distinct, and should stand as *L. nicobaricus*, Wood-Mason and de Nieéville. Herr Kheil's *Plebeius siraha*, from Nias, is apparently the same as *L. bochus*, but why he should compare it with *Plebeius balliston* (*Lycænesthes bengalensis*) I do not know.

37. LAMPIDES SUBDITUS, var. TELANJANG. Female. Above, with the inner border of the black outer area excised by an entering angle. Hindwing with the outer bluish rings bounded inwardly by a broad dark band which is suffused anally with reddish. Below, the submarginal pair of fasciæ diffused and lunular. Hindwing with the orange forming a large area discally, extending above the radial vein and to the submedian, only three of the black spots complete, the inner zigzag line obsolete.

Only a single female taken, but *subditus* is so different from other species of *Lampides*, and this form is so distinct from *subditus*, that I have thought best to name it.

38. LAMPIDES ELPIDION, n. sp. A local form of *Lampides elpis*, the dark white-bordered submarginal spots of the hindwing separated from the basal blue by a broad unbroken dark wavy band: forewing with the blue pale and milky, the outer dark margin rather broad, the veins edged slenderly with black at the apex. Below the ground-colour is uniform pale reddish-brown, as in the dry season form of *elpis*. Prehensors as in *elpis*. I have compared this butterfly with a long series of Indian and with four Javanese males, and it seems a good local race, easily distinguished. It is very much larger than Herr Kheil's *Plebeius talinga*, which has the black border of the forewing much broader, and the inner band of the hindwing wanting.

39. LAMPIDES CELÆNO, Cramer. I identify this species with some doubt; a small pale-blue form, quite common along the shore. Another *Lampides*, which I have not been able to place, is pale grey above, with the border rather narrow on the forewing and reduced to a thread on the hindwing.

Herr Kheil describes a *Cyaniris* from Nias, *puspinus*, dubiously distinct from *C. puspa*. *Zizera karsandra* certainly occurs in Engano, but I do not seem to have taken it. Herr Kheil gives it in his Nias list under the name of *Plebeius lysimon*.

40. PITHECOPS HYLAX, Fab. Scarce.

Subfamily Gerydinae.\*

41. PARAGERYDUS UNICOLOR, Felder, (*horsfieldii*, Moore). The identity of *horsfieldii* and *unicolor* seems generally accepted by the German naturalists, and Mr. de Nicéville, who has examined Felder's types (three females) of *unicolor* at Vicuña, has come to the same conclusion.

*Paragerydus* certainly does differ considerably in aspect from *Allotinus*. I think it may be kept distinct from it for the present, on account of the approximate second and third subcostal branches in the forewing of the male.

Family PIERIDÆ.

42. TERIAS HARINA, Horsf. Only one taken. Herr Kheil does not record it from Nias.

43. TERIAS HECABE, Linn.

44. TERIAS SARI, Horsf. Taken only on the hills.

45. APPIAS HIPPO, Cramer. Only females taken. It may be the Javanese *Appias lycida*, and not *hippo*.

46. HUPHINA ETHEL, n. sp. Male, above white, all the veins, including the internal and medians, black, and bordered with diffused black scales, the cell and the upper median vein heavily bordered with black, the costa tinged with lemon. Outer border rather widely and equally black, a dark, diffused outer-discal band parallel with the margin as far as the internal vein, cutting off seven submarginal spots, all white except the first, which is bright yellow, slender, the last large and out-

\* In the 1889 volume of this Journal, by an unfortunate blunder I described the fore tarsi of the *Gerydinae* as like the middle and hind ones, in spite of my numerous drawings showing the contrary. I also gave Herr Kheil's *Allotinus aphocha* as equivalent to *horsfieldii*. *A. aphocha* may be distinct, though badly described, and figured only on the underside, where it is identical with *horsfieldii*. I now doubt if my proposed genus *Malais* is distinct from *Logania*, though a Bornean form resembling *L. sriva* does have the tibiæ short and thick.

wardly incised. *Hindwing*, rich ochreous yellow, (without any orange tinge) from the first subcostal vein to the hind margin; the outer border rather widely black (but not subanally), the outer part of the veins, except the submedian and especially the subcostals and radial, also black, bordered with diffused scales. *Below*, the white area is reduced on the forewing, the upper submarginal spots united in a large triangular bright yellow mass, only the lower two white, that above the upper median vein obsolete. *Hindwing* lemon yellow, ochreous yellow on the extreme anal margin, with greenish areas above and below the cell, especially around the subcostal veins; the dark brown border very wide, attaining the cell, enclosing six yellow spots, all large except the fourth which is obsolete, the first three more or less united.

The absence of all orange on the wings, the submarginal band of the forewing, the veins outlined with black on both wings, the very broad marginal dark band of the hindwing below, and the large extent of the yellow area, tinged with greenish below, easily distinguish this peculiar species from *Huphina lea* and *judith*.

Only one male, taken at Bua Bua.

#### Family PAPILIONIDÆ.

47. ORNITHOPTERA NEREIS, n. sp. A local form of *O. pompeius*, Cramer. *Male*. Above, black, the cell immaculate, the veins of the disc black, bordered with rather conspicuous whitish rays. *Hindwing* golden yellow, bordered with a deeply scalloped black band, which is only about  $\frac{1}{10}$  of an inch wide at the ends of the veins, the base black above the middle of the costal space, including the root of the cell; two (in one specimen five) black discal spots subanally in the gold. *Below*, the white streaks near the veins are more continuous, and the end of the cell is slightly touched with whitish; a little red at the base of the wings.

*Female*, with the outer third of the cell entirely dull whitish, the whitish streaks between the veins coalescing, and extending nearly to the outer margins, the black rays in the middle of the spaces not nearly reaching the cell; hindwing very dull golden, the border wide, the discal spots coalescing widely with each other and with the outer black band, so as to enclose small yellowish lanceolate spots in pairs divided by the veins. *Below*, the hindwing is dull pale whitish-yellow, without any golden tint; this area extends only to the upper subcostal vein and occupies two-thirds of the cell. Several males and two females were taken, but one of the latter was unluckily destroyed, and the other is worn.

This species seems nearest the South Indian *Ornithoptera minos*.

Herr Kheil calls the Nias form *O. amphrysus*, Cramer, but it seems unlikely that a Javan species should occur in Nias and not in Engano. *O. nereis* obviously differs from *amphrysus* in the absence of the yellow band across the forewing of the male. The opaque whitish-yellow of the underside of the female is a striking character, and distinguishes it from a Philippine form, which otherwise resembles it considerably, especially in the male sex.

48. PAPILIO (MENELAIDES) ARISTOLOCHIÆ, Fab. Only one specimen taken; it was quite small. The species seems wanting on the opposite coast of Sumatra, being apparently replaced by *Papilio antiphus*.

49. PAPILIO (ILIADES) OCEANI, n. sp. A local form of *Papilio memnon*, from Java. Male, above like *memnon*, but the lines of luteous scales on the forewing are nearly obsolete (slightly visible near the apex), and those of blue scales on the hindwing less conspicuous, and not nearly reaching the cell. Below, the red basal areas are wholly wanting, and the outer grey area much narrower, not at all enclosing the series of large black spots.

Female, forewing above heavily marked with pale luteous bands bordering the dark veins over the whole disc, entering the upper end of the cell, black rays in the middle of the spaces, the apex darker. Hindwing similar but with the luteous bands less conspicuous, enclosing a series of large black spots. Below, the red basal spots are present, but very small, the grey border slightly broader than in the male.

The absence of the red basal spots above and below in the male, above in the female, the obsolete markings of the upperside of the male, and the narrow band of the hindwing below in both sexes, easily distinguish this species from its allies.

Only one male and one female taken.

50. PAPILIO (CHARUS) HELENUS, Linn. var. ENGANIUS. The lines of luteous scales are conspicuous above and below, more or less whitish near the lower angle of the forewing; the red lunules of the upperside are absent, except the anal one, which is obscure. Below, the white area is large, the marginal white lunules are distinct, the submarginal orange ones small and obscure, wanting in the lower radial and upper median spaces, giving the insect somewhat the appearance of *Papilio prexaspes*; the female has a diffused white spot on each side of the radial vein.

51. PAPILIO (ZETIDES) AGAMEMNON, Linn. One tattered male, Bua Bua.

52. PAPILIO (ZETIDES) SARPEDON, Linn.

## Family HESPERIADÆ.

53. HASORA BADRA, Moore. Two males and a female taken, normal.
54. PADRAONA PALMARUM, Moore, var. KAYAPU. The black area beyond and below the cell of the forewing is nearly obsolete, the yellow band of the hindwing very wide. This is perhaps a distinct species, but as only one male was taken, I cannot be sure.
55. CHAPRA MATHIAS, Fab.
56. UDASPES FOLUS, Cram.
57. HIDARI IRAVA, Moore. One male.
58. TAGIADES ATTICUS, Fab. The two hyaline spots below the three subapical ones are absent in the male, the two at the end of the cell are joined in the female. The white area of the hindwing is very large in both sexes, extending to the outer margin, where there are three black spots.

## EXPLANATION OF PLATE I.

- Fig. 1. *Danais pietersii*, n. sp.  
 ,, 2. *Radena longa*, n. sp.  
 ,, 3. *Danais chrysea*, n. sp.  
 ,, 4. *Radena macra*, n. sp.  
 Figs. 5-8 refer to Mr. Doherty's other paper.

III.—*New and Rare Indian Lycaenidæ.*—By WILLIAM DOHERTY,  
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(With Plate I, Figs. 5-8.)

Family LYCÆNIDÆ.

Subfamily THECLINÆ.

1. ARHOPALA KHAMTI, n. sp. Pl. I, Fig. 5.

Near *A. aënea*, Hew., differing in the dark, dull indigo-blue of the upperside, and the darker shade of the underside, with the terminal cell-spot remote from that in the lower median space of the forewing; hindwing with a large subanal ocellus bordered with metallic green, which